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INSECTICIDAL AND SYNERGISTIC ACTIVITY OF *ATRIPLEX HALIMUS* L. EXTRACTS

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ABSTRACT

The acetone/ ethanol, petroleum-ether, ether and chloroform extracts of *Atriplex halimus* L. proved to be with considerable toxicity to *Culex* larvae with LC_{50} values of 115, 36, 54 and 48 ppm, respectively. Out of the different extracts of *A. halimus*, the ether and pet-ether extracts showed strong aphicidal activity against *A. gossypii* with LC_{50} values of 0.059 and 0.085%, respectively. Only the ethanol extracts were found to be toxic to the cotton leafworm with LD_{50} value of 5.6 mg/larva. All of the tested extracts were non toxic to the stored product insect, *T. castanum*. Organo-phosphorous (OP) insecticides synergism studies revealed that the pet-ether and ethanol extracts of *Atriplex* strongly synergized the toxicity of reldan and actellic in *Tribolium castaneum*.

INTRODUCTION

The rising consumption of currently used insecticides in developing countries has led to a number of problems such as insect resistance, danger to pesticide appliers, toxicity to non-target organisms, environmental pollution and the health hazards associated with pesticide residues. These facts, in currency, have stimulated considerable interest in plants as a source of pesticides in developing countries. Many plant species possess selective action against a number of pests through biological activities such as toxic, antifeedant, and insect growth regulatory. There are about 2000 plant species

reported to possess pest control properties, of whch 26 appear to be ideally suitable as pest control materials (Ahmed et al., 1984). *A. halimus* L. is widely distributed in the various zones of Egypt. This plant was noticed to be rarely attacked by insects in the field. It seems reasonable to assume that this plant contains insecticidal principles. Therefore, the present study was conducted to investigate the insecticidal and/or synergistic activities of the different extracts of *A. halimus*.

MATERIALS AND METHODS

Identification of tested plant: Flowering specimen of the plant tested was identified according to the taxonomic characters (Tackholm, 1974) as *Atriplex halimus* (L.), Fam. Chenopodiacease. For preparation of extracts the leaves of *A. halimus* L. were air dried at room temperature and ground to fine powder. Plant powder was exracted in Soxhlet apparatus using acetone/ ethanol (1:1) at a rate of 250 gm/liter of solvent for 4 hours (almost to exhaustion). In another plant sample, the successive extraction was done using petroleum-ether, ether, chloroform and ethanol successively on the same sample. Extracts were filtered and each filtrate was allowed to dry and evaporated to dryness. The crude extracts were weighed and solubilized in acetone and preserved in a refrigerator till use in the bioassay tests. Tested pests were the laboratory cultures of mosquito larvae, *Culex pipiens* L. 4th instar larvae, cotton aphis, *Aphis gossyii* (Glov.), apterous adults (1-2 day old); cotton leafworm, *Spodoptera littoralis* 4th instar larvae and *Tribolium castaneum* adults. Insecticidal activity of the isolated botanicals was done according to the methods of Abbassy et al. (1979), FAO (1980) and Abbassy et al. (1982). Mortality count were considered after 24 hr. from exposure and mortality percentages were corrected according Abbott' formula (1925). LC_{50} and LD_{50} values were calculated according to Litchfield and Wilcoxon (1949).

Synergism studies: Each plant extract was mixed with each insecticide at a ratio of 1:1 (w/w). The toxicity of each insecticide alone and in combination with the plant extracts was determined against the control insect *T. castaneum*. The synergistic ratio was calculated according to Metcalf (1967).

RESULTS AND DISCUSSION

Atriplex halimus L. was noticed to be rarely attacked by insects in the field. It seems reasonable to assume that this plant contains insecticidal principles. The toxic effect of the plant extracts was tested against mosquito larvae as recommended by Busvine (1971). The acetone/ethanol extracts of the leaves proved to be toxic to mosquito larvae (LC_{50}: 115 ppm) (table 1). This result revealed that this plant displayed distinct toxicity which cannot be ignored in relation to other toxic plants (Jacobson, 1958). As toxicity may be enhanced by fraction of the active constituents contained in the plant, successive extraction was done with different solvents. The pesticidal activity of the different extracts was determined. Against mosquito larvae, pet-ether extracts were more potent larvicide with LC_{50} of 36ppm followed by chloroform and ether extracts with LD_{50} of 48 and 54ppm respectively, (table 1). On the other hand, ethanol extracts were non-toxic up to 500 ppm. These results revealed that the insecticidal effect of pet-ether, chloroform and ether extracts was greater than that of acetone/ethanol extracts.

Against cotton aphid, it was found that only pet-ether extracts were active as aphicides against the adults of *A. gossypii*. Their LC_{50} values were 0.085 and 0.059%, respectively (table 2). The presence of aphicidal constituents was reported in other plants (Goyal et al., 1971). Against cotton leafworm, only the ethanol extracts were found to be toxic to the 4th instar larvae of *S. littoralis* with LD_{50} value of 5.6mg/larva as recorded (table 3). The toxicity of the ethanol of *Atriplex* was found to be more effective against the cotton leafworm than those of many other plant extracts as reported by EL-Gayar et al. (1979) and El-Doksh et al. (1984). On the other hand, all of the tested extracts were non-toxic against the stored product insect *T. castaneum*.

Interaction of *A. halimus* extracts with synthetic insecticides in the stored product insect, *T. castaneum*: Some plant extracts were tested for their synergistic effect on the OP insecticides, pirimiphos-methyl (actellic) and chlorpyriphos-methyl (reldan), to *T. castaneum*. Each plant extract was mixed with each insecticide at a ratio of 1:1 (w/w). The toxicity of each insecticide alone and in a combination with

the plant extract was determined against the tested insect. The LC_{50} values for each insecticide and its combination was determined as previously described. Of the tested extracts, only two extracts increased the toxicity of the tested insecticides (table 4). The petroleum-ether extracts of *Atriplex* strongly synergized chlorpyriphos-methyl with a synergistic ratio of 2.8x, while the ethanol extracts synergized only pirimiphos-methyl with a synergized ratio of 1.4x.

Table (1): Insecticidal activity of the exctracts of *Atriplex halimus* L. against *Culex pipiens* L. larvae.

Atriplex extracts	LC_{50} ppm	Confidence limits	Slope
Acetone/ethanol	115	58.4 -2 66.6	–
Petroleum-ether	36	22.5 - 57.6	1.75
Ether	54	34.8 - 83.7	1.9
Chloroform	48	28.2 - 81.6	2.0
Ethanol	>500		

Table (2): Aphicidal activity of the extracts of *A. halimus* L. against *Aphis gossypii*.

Atriplex extracts	LC_{50}	Confidence limits	Slope
Petroleum-ether	0.085	0.055 - 0.154	0.94
Ether	0.059	0.018 - 0.09	1.33

Reviewing the available literature, it could be mentioned that no attempts have been done to test the insecticidal and/or synergistic activity of the extracts of *Atriplex*. So, it is interesting to prove that this plant has a promising insecticidal effect, and synergistic effect to the organophosphorous insecticides.

Table (3): Insecticidal activity of the ethanol extracts of *A. halimus* against *Spodoptera littoralis* (Boisd.)

Atriplex extracts	LC_{50} Mg/larvae	Confidence limits	Slope
Ethanol	5.6	5.3 - 20.0	0.73

Table (4): Increase in the toxicity of OP insecticides, actellic and reldan, with *Atriplex* extracts against *Tribolium castaneum* adults.

Insecticide and Insecticidal mixtures	LC50	Confidence limits	Slope	Synergistic Ratio
Actellic	80	64.5 - 98.9	2.92	
Actellic + $Atriplex_1$	57	39.6 - 82.1	2.8	1.4
Reldan	42	23.5 - 75.2	1.54	
Reldan + $Atriplex_2$	15	6.82 - 33.0	1.27	2.8

Atr_1 = Ethanolic extracts of *A. halimus* L.
Atr_2 = Pet.-ether extracts of *A. halimus* L.

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